5

MAPPING INTERDISCIPLINARY DESIGN RESEARCH AS FLOW AROUND A MEDIDISCIPLINARY SEA

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Mapping research as exploration

Any research, including design research, might be thought of in terms of exploration – a journey into the unknown, or not-yet-known. Making maps that represent processes is always an interesting exercise in visualisation. There are many precedents, including Charles Eames's iconic diagram of the design process (Neuhart, Neuhart and Eames 1989: 13). In *Table-Top Geography* (see Figure 5.1), illustrator Helen Murgatroyd plots out the preparation of food dishes, making intriguing maps of everyday activities. Murgatroyd was herself inspired by the work of Alfred Wainwright and Mark Lombardi, mapping landscapes and networks respectively.

This chapter arose out of an attempt to draw a map of a design research project. This endeavour has led to a new perspective on the nature and role of design research in an interdisciplinary context. The initial model was that of an expedition, since the research included two PhDs which, although initially together, separated half way through, each to pursue its own agendas. In the way that Antarctic expeditionary maps often show different parties – perhaps one party returning to base whilst a smaller group strikes out for the Pole – it was hoped that this relationship between the projects might be shown on a map.

The first question though was onto what landscape, which framework, to map the journeys.

(Re)introducing the interaction design research triangle

Frayling and Fallman

Christopher Frayling's categories of 'research into design', 'research for design' and 'research through design' (Frayling 1993) are still valuable in identifying different roles for design research and different modes of enquiry. To a design researcher joining academia following a career at the consultancy IDEO, however, this distinction sometimes seems to divide aspects of practice-led research practice that feel inseparable.

Fifteen years later, Daniel Fallman introduced *The Interaction Design Triangle of Design Practice, Design Studies, and Design Exploration* (Figure 5.2, left) in a paper of the same name (Fallman 2008). It was Fallman's contention that interaction design research in particular is characterised

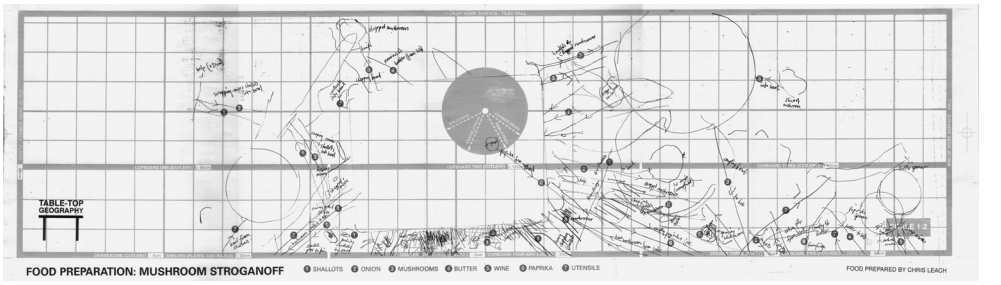

Figure 5.1 *Table-Top Geography* by Helen Murgatroyd

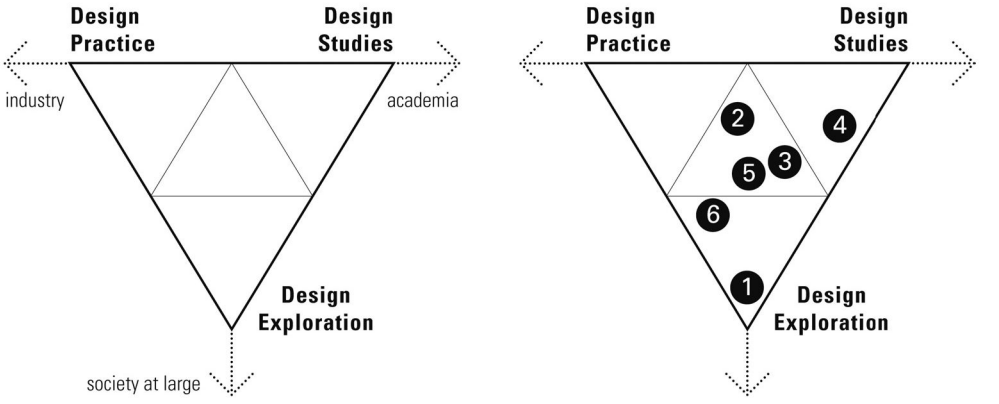

Figure 5.2 *The Interaction Design Triangle* as introduced by Daniel Fallman (Fallman 2008, redrawn by the author) (left); *The Interaction Design Triangle* as used by Joyce Yee to map six practice-based design PhDs (Yee 2010, redrawn by the author) (right)

by a flow between three modes of enquiry – in combination. By Fallman's definitions, 'design practice' denotes activities that are very close, and sometimes identical, to those undertaken when practising interaction design outside of academia (Fallman 2008: 6). 'Design exploration' is different from design practice:

> primarily due to the perspective from which the artifact is being constructed. In design exploration, the most important question is: 'What if?' As a sign of recognition, design exploration research almost always excels in what Schön calls 'problem-setting', and Ehn refers to as 'transcendence' (i.e. exploring possibilities outside of current paradigms – whether these are paradigms of style, use, technology or economical boundaries).
>
> *Fallman 2008: 7, referencing Schön 1992: 3–14, and Ehn 1988*

'Design studies' most closely resembles traditional academic disciplines and is also where influences from other disciplines are most visible (Fallman 2008: 9).

Fallman reports that the model has proved useful over a number of years at Umeå Institute of Design (Fallman 2008: 15), where he is a Professor of Informatics.

Appropriating the Triangle

The paper has ranked fifth most downloaded article from *Design Issues*, in a list including papers from 2001 to 2014 (MIT Press Journals 2014). Another sign of its influence is that researchers elsewhere have appropriated the Triangle. Joyce Yee mapped six practice-based design PhDs, each influential in their methodological innovation (Yee 2010). To serve this purpose, Yee plots each PhD on the Triangle (Figure 5.2, right): Ramia Mazé's (Mazé 2007) "inquiry into issues of time in interaction design" (Yee 2010: 11) appears at the very centre of the Triangle (labelled No. 5 in Figure 5.2, right), whereas Anthony Dunne's pioneering of a critical design methodology (Dunne 1997) is positioned towards the extreme of design exploration (and labelled No. 1 in Figure 5.2, right). Plotting each as a point on the Triangle is not strictly in line with Fallman's notion of loops, which we will come to, but Yee's purposes are different: by mapping the centres of gravity of six PhDs, something is revealed of their spread.

Using the Triangle

Six Speaking Chairs and *Speech Hedge*

The case study involves two connected and complementary projects. Their common goal is to provoke discussion about the importance of the tone of voice of synthetic speech in what are known as voice output communication aids, of which Stephen Hawking is the most famous user. Tone of voice – here used to mean the ability to say the same words in subtly different ways and with different conversational outcomes – is all but missing from most communication devices. These are typically based on Text-To-Speech (TTS) technology in which any word can be spoken, but the only control over *how* a word or sentence is spoken is basic punctuation: a full stop for a supposedly neutral intonation, a question mark for a rising intonation or an exclamation mark for a louder or otherwise more emphatic delivery. This does not even scratch the surface of how most of us employ our tone of voice in everyday conversation to convey meaning, exert influence and deepen relationships. But while we might all recognise tone of voice when we hear it, it is an elusive quality that even phoneticians struggle to define (Fox 2000). This is challenging territory. Design research can contribute to many areas by visualising intangible issues. In this case, designers can help to seed debate about the importance of tone of voice as well as by proposing interfaces by which we might actually control it.

Six Speaking Chairs, a collaboration with Andrew Cook (Pullin and Cook 2010a), is a collection of interactive exhibits that make different ways of thinking about tone of voice accessible to laypeople, in order to provoke new conversations (Figure 5.3). Each of the chairs represents a different mental model, visualised in an archetypical user interface. So, phoneticians' intonation diagrams are represented by a touchscreen, drawing on which will control the timing and pitch contour of a spoken word, in real time; whereas the heterogeneous stage directions of a playwright (Shaw 1916) are represented by numerous doorbells with descriptions scribbled under each: coyly, coaxing, whimpering, whispering and so on (Figure 5.4, left). Note that these descriptions include conversational intent, not just emotional state – which tone of voice is too often more narrowly defined as (Campbell 2005).

Figure 5.3 *Six Speaking Chairs* by Pullin and Cook, in which found chairs and interactions are employed to embody different ways of thinking about tone of voice, found in diverse disciplines

Source: Authors' photograph

Figure 5.4 *Six Speaking Chairs* showing Chair No. 6 with its 17 doorbells, each labelled with a stage direction from *Pygmalion* (Shaw 1916). The invitation to 'please customise' formed the basis of a participatory exercise, '17 ways to say yes' (left); *Speech Hedge* showing a Toby Churchill *Lightwriter* alongside the Apple *iPhone* interface. The tone 'Apologetically' represented by a plant made up of six elemental leaves formed the basis for a further participatory exercise (right)

Speech Hedge, a collaboration with Ryan McLeod, is a more conventional, but still imaginative, concept that explores how subtly nuanced tone of voice might even be introduced into communication devices in the near future. It proposes an app running on an Apple *iPhone* as an accessory to a more conventional communication device (Figure 5.4, right). The phone displays a choice of 16 tones of voice which can be chosen as a modifier of the speech coming out of the TTS device. Each of these tones is represented as a seedling, a diagram of a plant with a few different coloured leaves. Each has been assembled by the user themselves, or another layperson, by combining leaves in different combinations (with 16 colours and up to eight leaves there are over a million combinations – colour mixing on a computer monitor is not a bad analogy – although with no guarantee that all will be useful or even sound human). Tones that sound useful are then subjectively labelled by their creator and collected or shared.

Mapping the projects

Fallman reports that at Umeå most PhD projects take "the form of loops in between at least two of the activity areas" (Figure 5.5, left):

> Loops, as the name suggests, are trajectories without either starting or end points that move in between different activity areas. . . . loops are crucial in that they represent what sets interaction design research apart from other research: the ability to move freely between design practice, design exploration, and design studies.
>
> *Fallman 2008: 11*

Within the Triangle, mapped according to Fallman's original guidance, *Six Speaking Chairs* involves a loop between the activity areas of design exploration and design studies (Figure 5.5, right). That is it is fundamentally a design exploration, drawing inspiration from Dunne and Raby's *Placebo* (Dunne and Raby 2001) and Goldsmiths Interaction Research Studio's *Curious Home* (Gaver et al. 2007) projects, received through their publications – therefore through design studies. Within the Triangle, again mapped according to my interpretation of Fallman's guidelines, *Speech Hedge* also involves a loop, but this time between design exploration (the project definitely asks: "What if?") and design practice, because its reference points are interaction design as practised in industry (Figure 5.5, right).

Fallman has reviewed this use of his diagram and declared it to be "more or less *exactly* as I had hoped people would use it . . . The illustrations . . . are spot on what I had hoped for!" (Fallman 2012).

Inverting the Triangle

So far, so good. These mappings visualise the activities internal to design research. But the most interesting aspects of these projects involved their interactions with individuals and disciplines beyond design research.

Presentation of *Six Speaking Chairs* was followed by an exercise based on Chair No. 6, the one with 17 doorbells. Participants – including speech and language therapists, people without

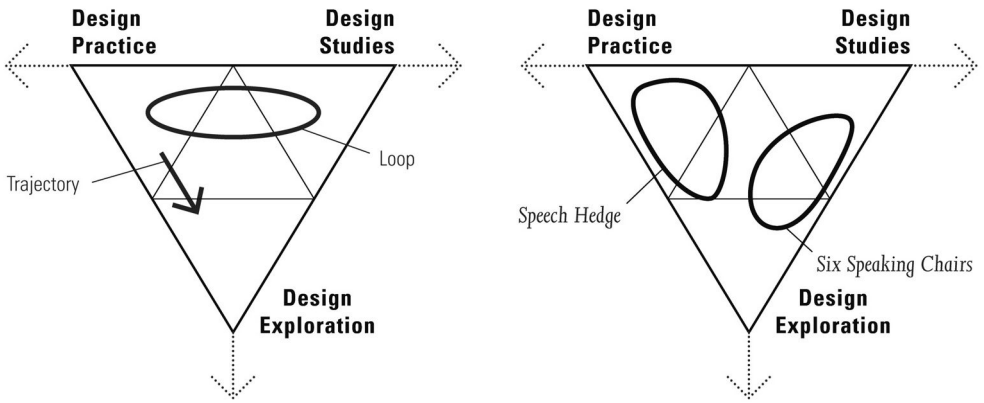

Figure 5.5 Loops on the Interaction Design Triangle as shown by Fallman (Fallman 2008: 11) (left); Loops on the Interaction Design Triangle as *Six Speaking Chairs* and *Speech Hedge* mapped as loops (right)

speech and speech technology researchers – were asked to list the tones of voice that they would choose, were they to be restricted to just 17 for the rest of their lives (restricted or, in the case of people using communication aids, significantly expanded!) The responses were illuminating: between just 40 respondents there were some 250 unique descriptions of tone of voice. More important still, less that 40 per cent of these were 'emotional' descriptions such as 'happily', 'sadly', 'angry' or 'afraid', which are so often assumed to encompass expressive speech.

Presentation of *Speech Hedge* was followed by an exercise in which diverse participants were asked to compose complex or subtle tones of voice – such as 'coaxing' – by combining elemental tones. The responses demonstrated a remarkable shared understanding, suggesting that a user interface based on similar principles might be intuitive to laypeople, rather than only speech technologists.

How might this interdisciplinary interaction be mapped? Exploring its evolution is in no way a criticism of the Triangle – the original purpose of which was to differentiate qualities of interaction design research from Human-Computer Interaction (HCI) and other related disciplines. The purposes of this chapter are different: to contextualise interaction design within less related, more diverse disciplines, within interdisciplinary research. So this is a complementary tool – a different way to use the Triangle in order to illuminate different things.

Landscapes and seascapes

In his dissemination of the *Designing for the 21st Century Research Initiative*, Tom Inns includes a map that combines a timeline of design history with a more interdisciplinary view through the metaphor of a river estuary.

> Finding relationships between the 41 research projects supported by the *Designing for the 21st Century Initiative* is complex. To make sense of this broad portfolio I often think of each project as being a research ship within *The Interdisciplinary Design Delta* shown above.
>
> *Inns 2010: 10*

Workshops are integral to Inns' own research process, and these often involve mapping exercises. In one workshop, focused on design management, participants were asked to annotate a pre-printed fictitious map showing the islands of design management education, practice and research (Figure 5.6, left). Each group was asked to mark up:

> Who lives on each island? How do the islands trade with each other? What do they import and export? What are the trade routes? What are the currencies? What bridges need to be built? How do they cope with changing tides?
>
> *Inns 2009: 20*

One participant inverted Inns' map: the word 'ocean' is crossed out and has been renamed 'The Continent of Design'. Correspondingly, the three islands become two lakes and a pond, and smaller islets become swimming pools (Figure 5.6, right).

This seeded the idea of a similar inversion of the *Interaction Design Research Triangle*, one in which more attention is paid to mapping journeys across and beyond the bounds of the Triangle (Figure 5.7, right) than within it (Figure 5.7, left). So if it ever represented a landscape (Fallman does not use this metaphor, just talks of 'areas') it is now an inland sea. All of a sudden, it is less a map *of* design research than a map of everything surrounding design research, everything acted upon *by* design research.

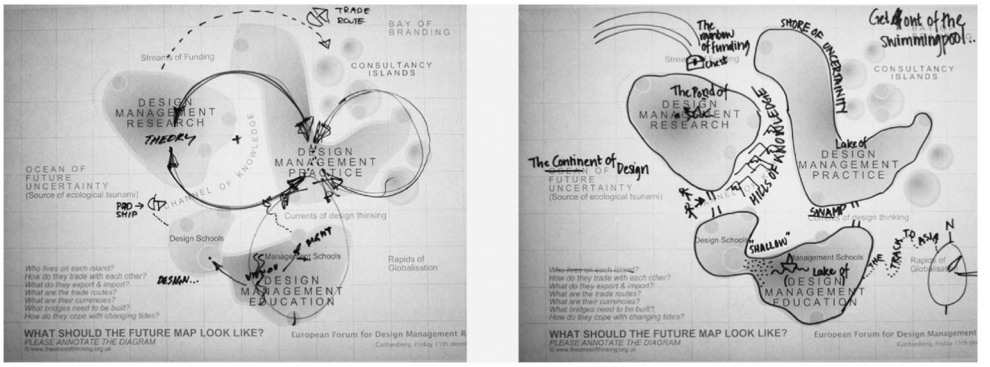

Figure 5.6 Tom Inns' exercise in mapping design management research with design management as islands (Inns 2009: 20) (left); Tom Inns' exercise in mapping design management research with the map inverted, the islands turned into lakes in 'The Continent of Design' (Inns 2009: 18) (right)

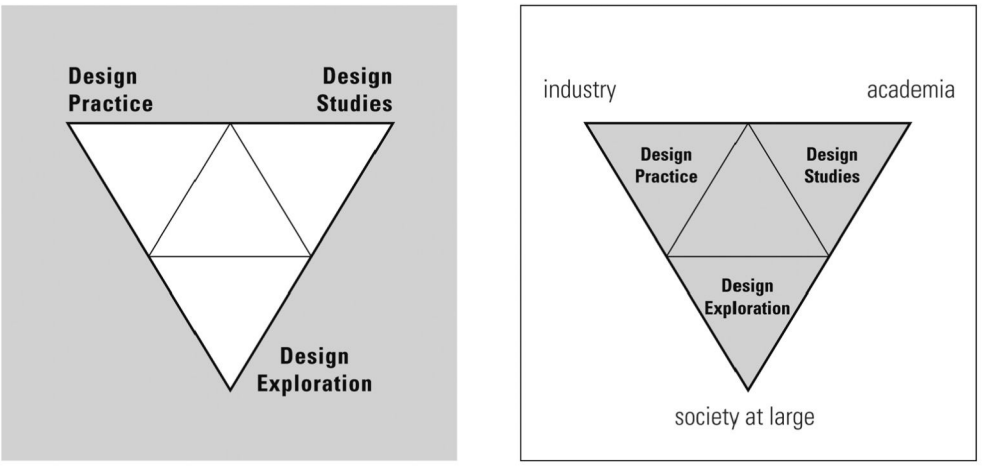

Figure 5.7 Inverting the Interaction Design Triangle to reflect the current emphasis on the area inside the Triangle, the area outside is shaded (left); The Interaction Design Triangle shaded inside, with the area outside the Triangle left open for mapping (right)

Redrafting the Triangle

A number of minor changes have been made to Fallman's Triangle – at a level of draftsmanship, rather than reinvention: I have interpreted Fallman's writing that "[his] triangle presents a two-dimensional space for plotting the position of a design research activity drawn up in between three extremes" as meaning that design research activity takes place *within* the bounds of the Triangle. Inside and outside will become significant later, so the three extremes, 'design practice', 'design studies' and 'design exploration', are therefore rewritten just inside the Triangle, referring to the points of the Triangle. On the other hand, Fallman talks of "three vital, external interfaces" with "industry", "academia" and "society at large" (Fallman 2008: 5). Therefore, these three terms are written outside the Triangle (Figure 5.8). Since there is no written

reference to any asymmetry of the Triangle, or of any hierarchy between its three points, it will be redrawn as an equilateral triangle.

Remapping the projects

In attempting to remap the projects as much outside as inside the Triangle, the first challenge is to identify the disciplines, fields and communities, beyond design research, that they involved. The area of assisted communication for people with 'complex communication needs' is itself complex. It involves speech, disability and technology (Higginbotham 2010) and the overlaps between them: speech and disability overlap in the field of augmentative and alternative communication (AAC), which also includes sign language and communication boards, so is not always based on 'technology' in the digital sense; disability and technology overlap in the area of assistive technology, which also includes wheelchairs and hearing aids; technology and speech overlap in the area of speech technology, including speech recognition and speech synthesis.

The next step is to orientate these disciplines to the axes of the Triangle, looking at the primary areas of speech, disability and technology. *Six Speaking Chairs* involved the study of speech outside of disability or technology, including the academic disciplines of phonetics and linguistics, so 'speech' can be aligned with 'other disciplines', adjacent to design studies; although 'disability studies' is also an academic field, the mantra 'nothing about us without us' (Charlton 1998) makes it appropriate to align 'disability' with Fallman's 'society at large', adjacent to design exploration; technology, in this case digital technology, is closely associated with 'industry' and adjacent to design practice (Figure 5.8).

This means that the overlaps between these fundamental fields have fallen as follows:

- AAC is positioned between academia and society at large – which feels appropriate for a field rooted in clinical practice and with a strong participation of disabled people;
- assistive technology is positioned somewhere between industry and society at large – which might mean between mainstream markets and the particular needs of disabled people;
- speech technology is positioned between academia and industry – which feels appropriate for an area in which development and commercialisation are important activities.

Not that alternative orientations are not possible. In discussion, Fallman thought that in theory at least you could swap some of them and the model would still make sense: "So if you for instance swap disability and speech you get a very different perspective. But on the other hand, maybe that's not really a problem" (Fallman 2012). Agreed, because the goal is not to establish a definitive perspective, rather to illuminate from new perspectives.

Beyond the Triangle

The differing nature, role and audiences for the two projects, *Six Speaking Chairs* and *Speech Hedge*, lend them quite different traces on the map (Figure 5.8). The first incarnations of this were reminiscent of Murgatroyd's plotting, with events marked individually. The version presented here is simplified and more reminiscent of Eames's diagram – although the act of mapping itself may well be where the main value lies to the researcher.

Beyond the Triangle, *Six Speaking Chairs* involved deep excursions into unfamiliar territory, so the mental models represented by each chair are not invented so much as uncovered. They are found objects from foreign fields. As such, the creation of the chairs was as much an act of curation as of design – which is one reason why it employs found chairs, rather than new or

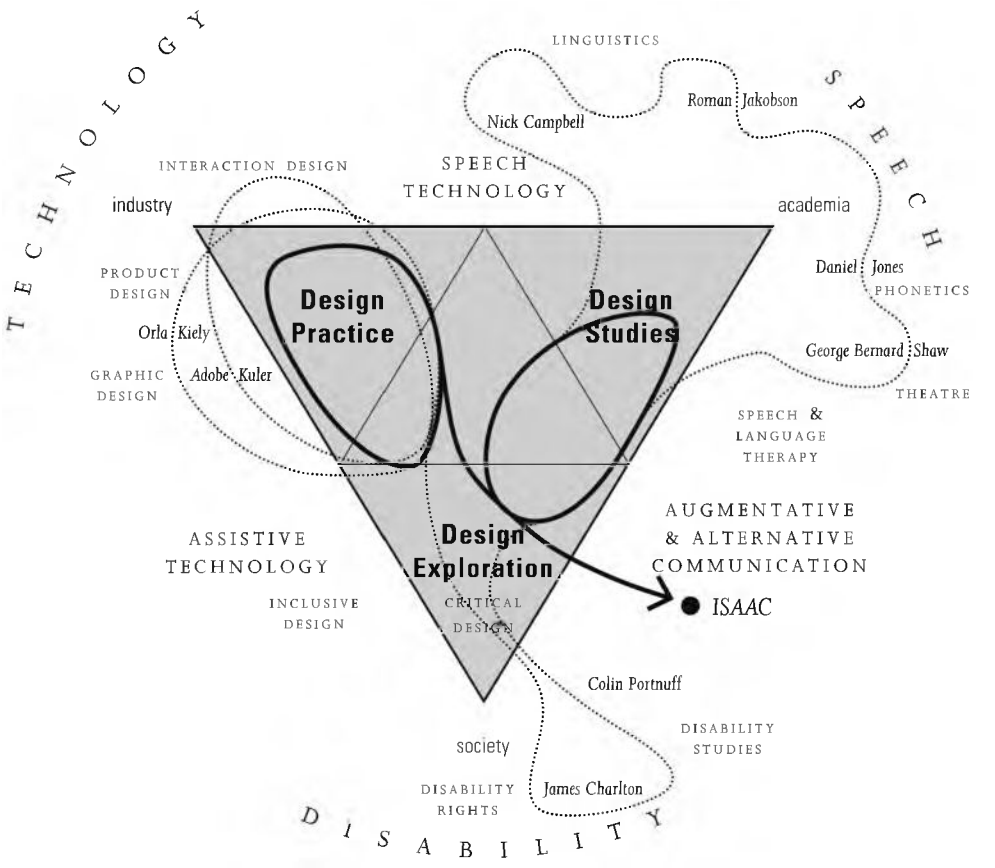

Figure 5.8 Mapping the circulation of knowledge and ideas on *Six Speaking Chairs* and *Speech Hedge* using the Triangle. Dotted lines show excursions 'inland', particularly incursions into linguistics, phonetics and the theatre to gather models of tone of voice. The arrow shows the flow of ideas to the primary audience: augmentative and alternative communication

specially designed ones (Pullin 2010). The expeditionary nature of the study is discernable in the mapping. The incursions inland provided raw materials for the design exploration, but are not integrated into the activity of design.

Outside the Triangle, *Speech Hedge* was much more informed by the state of the art in speech technology and in particular the Centre for Speech Technology Research at the University of Edinburgh (Clark et al. 2007) – but there was also more spontaneous inspiration from contemporary interaction design and graphic design, in particular the work of Orla Kiely (2010), which seems more part of design practice. These sources are more evident from the perspective of design (they are closer to the coast of our inland sea). The role of *Speech Hedge*, in contrast to that of the chairs, is to integrate these elements into a coherent whole. One that still invites critical reflection, as much about whether this is a desirable goal as whether or not it is feasible.

Whilst both projects lend themselves to several diverse audiences, their roles are quite different. The role of *Six Speaking Chairs* is to encourage divergent thinking, and their ambiguity as objects, as well as their multitude, is an important mechanism. *Speech Hedge* presents a much clearer "What if?", more focused and I hope still thought-provoking. The ambition for *Speech*

Hedge is to influence the assistive technology industry. Whereas the aspiration for *Six Speaking Chairs* would first be to influence future research into augmentative and alternative communication – its role is more indirect, catalytic, provocative.

Transcending exploration

Influence and impact

For this research, the primary audience is the field of augmentative and alternative communication (Pullin and Cook 2010b), rather than a design research audience (this chapter being a by-product rather than the original goal). An important hub for both projects – a place returned to again and again – is the biennual conference of the International Society of AAC (ISAAC). ISAAC is attended by a healthy mix of clinicians, researchers, people with complex communication needs as well as manufacturers, so for this reason it is placed mid-way between disability and speech, society and academia. It is here that the research is intended to have the most influence. So the interactions with this community should be prominent.

In 2006 (Pullin and Alm 2006), ISAAC was used to sound out the idea of applying critical design to this area; in 2008 (Pullin and Cook 2008), the *Six Speaking Chairs* were introduced and the audience responded with their 17 ways to say yes; in 2010, the first insights from the *Six Speaking Chairs* were shared (Pullin and Cook 2010b); in 2012, this research formed the basis of the keynote lecture for the state of the science conference for the Rehabilitation Engineering Research Center on Communication Enhancement in Baltimore (Pullin 2012); and in 2014, a paper including design principles distilled from this research will be submitted to the academic journal AAC as a Forum Note – an influential format of academic paper, to which responses are encouraged and published.

Returning to Fallman and Frayling

Beyond the specifics of these two projects, in their landscape of speech, disability and technology, does this mapping illuminate anything more generic about interdisciplinary design research? One observation is that whilst the areas inside the Triangle are generic – the whole point being that they are common to any (interaction) design research – the areas outside the Triangle are project-specific. Speech, disability and technology refer to *Six Speaking Chairs*, but not to Dunne's, Mazé's or Fallman's own PhD students' projects. Being more specific about these illuminates the relationship between academia, society at large and industry; it acknowledges that these already have relationships with each other and that these existing relationships are part of the context in which design research takes place; it may facilitate new connections, but it is rarely the sole bridge between them.

Daniel Fallman is supportive of this exploratory evolution of the Triangle in order to illuminate different aspects of design research. "Your idea of 'looping' outside of the model is a valid contribution and one which happens a lot in all kinds of design research" (Fallman 2012). Fallman has himself employed the Triangle as a starting point to illuminate further issues, in particular those of rigour and relevance in design research – criteria that he and Erik Stolterman propose mean different things within the three different design research activities (Fallman and Stolterman 2010).

Returning to Frayling, the mapping combines research for design (including the incursions into other fields) and research into design (including the reflections on design research) whilst making it clear that the emphasis is research through design. Design research is being applied to research into augmentative and alternative communication.

Exploration and trade

Having begun with exploration as an evocative metaphor for research, exchanging knowledge between disciplines alludes even more closely to trade, whatever it is that is exchanged between the parties. The circulation around the *Interaction Design Research Triangle* brings to mind the ancient Mediterranean trade-routes of the Phoenicians. "We could say of ancient Phoenicia that it was an early version of a world-economy, surrounded by great empires" (Braudel 1984: 25). "Maritime trade, not territory, defined their sphere" (Abulafia 2011: 64).

An analogy might be made with design, amongst other disciplines, by positioning design in the space between other disciplines, without laying claim to their territories (Figure 5.9). At the same time, this advocates that design research can play a unique role in interdisciplinary research. Perhaps this role for design research might even be described as *Medidisciplinary*.

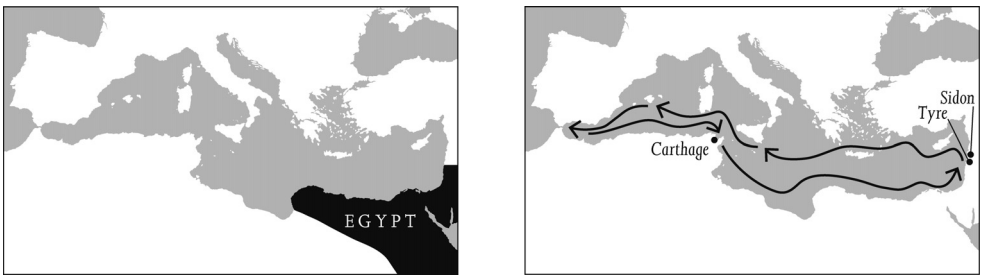

Figure 5.9 Mapping ancient civilisations – ancient Egypt, defined by its territory, as an analogy for a traditional specialist discipline (left); Ancient Phoenicia, defined by its Mediterranean trade routes – a possible analogy for design research? (right)

Any mention of trade brings with it consideration of fair trade, of giving something of equal value in return; ethical rather than exploitative. And in the current academic climate, beyond traditional citations, evidence of 'impact' – particularly influence in *other* fields and public-facing activities – is of value in representing the value of research. In the case of the *Six Speaking Chairs* it is certainly not just that disciplines such as phonetics and linguistics are being mined for raw materials to be brought into design itself: these insights become valuable when conveyed to the communities of augmentative and alternative communication and even back to speech technology. Design research is not just playing a collaborative role but a mediating role.

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